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SUMMARY OF THE CONFERENCE ON ODOR CONTROL

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Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

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Build-up of pollution in the air we breathe is prevented by turbulent mixing due to vertical and horizontal differences in air density. Some meteorological conditions suppress air mixing. An increase of temperature with height, called an "inversion", suppresses vertical mixing. Because the warming and cooling of the lower air stratum depend upon the presence or absence of sun and clouds, a diurnal cycle results, with inversions forming on clear nights and being broken up by the heat of the daytime sun. Therefore, in hilly country like Greater Cincinnati, the diurnal maximum pollution occurs in the bases of our valleys just after sundown. Higher up the slope, the maximum occurs progressively later until about 2:00 a.m., and again about a half hour after sunrise.

Daytime break-up of the inversion may be prevented by compression by an incoming warm front or by a persistent stagnant high-pressure system. This latter is what caused the local "smog" of October 15-16, 1956. Such conditions can be expected to occur about three times a year, during Indian Summer. These smogs are distinguishable from natural fogs in that the latter require more than 87 per cent relative humidity, whereas this recent smog persisted after humidity dropped to 40 per cent relative. However, because of increased nucleation of the atmosphere produced by human activities, fogs are now more frequent

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and persistent than several generations ago. The local air soiling index generally shows highest pollution early in the morning, and lowest around 2:00 p.m. The Cincinnati soiling index measured during the recent smog in Cincinnati was the highest since measurements began in 1952. Because of a combination of weather factors, most odor complaints occur between 8:00 p.m. and 2:00 a.m. on summer evenings and again soon after sunrise.

Abatement of odor sources requires both management support and technical know-how. Management, in accepting responsibility for such abatement, follows a four point plan: (1) Learn the facts - preferably in quantitative terms such as "odor units" of emission. (2) Decide what to do - determine what decrease in "odor units" is necessary to abate the nuisance. Assume that future standards as to necessary abatement may be more stringent than present standards. Improvement in operating practices can sometimes effect as much as 30 per cent improvement without adding any new equipment. (3) Plan action on the basis of most economical scheme for abatement. Evaluate economics on the basis of least cost per "odor unit" abated. (4) Follow up action to see that scheme is put into effect and kept operative.

The above plan puts considerable reliance on quantitative odor measurements. Both static and dynamic measurement methods are available, all involving dilution to odor threshold concentration and observation by trained persons who preferably should be chosen by screening to eliminate anyone with abnormal odor perception. Observers should be

used as panels of several members rather than as individuals. The tendency of observers to try to outguess or outwit the test must be reckoned with in such subjective measurements and compensated for by the use of blanks and sufficient numbers of samples.

A prime odor control method is combustion, examples of which are the flare, the high temperature furnace, and catalytic combustion. Combustion can be used where the odorous contaminant is safely combustible and where the products of its combustion are not objectionable. Complete combustion of ash-free hydrocarbons to water vapor and carbon dioxide meets these specifications. Combustion of sulphur and ash-bearing substances can introduce objectionable substances to the atmosphere. Another control method is absorption, in a packed tower, spray column, spray chamber, or wet filter, usually having water or an aqueous solution as the absorbent. Disposal of the scrubbing liquid can present real difficulties and in solving an atmospheric odor problem, create a water pollution problem.

Chemical odorants, masking agents, or counteractants can be added both to industrial processes and to their effluent gases. Relatively small quantities of additives can change the odor observed in the neighborhood of the source and so eliminate some complaints. Similarly, discharge of odorous effluents from high stacks can decrease the frequency of odor complaints near a source. Since neither of these two methods of odor control reduces emission to the atmosphere, they do not prevent build-up of pollution concentration under a prolonged

inversion ceiling.

Other odor control methods include adsorption of the odorous substance on a material such as activated carbon; process change to reduce the formation of odorous substances; and good housekeeping, to prevent the creation of odor from waste on floors, in dumps, and other unconfined areas.

Although there has been a 90 per cent reduction in smoke emission in Cincinnati since 1947, the number of air pollution complaints has doubled in the last five years. In 1955 more than half these complaints were of odor. Abatement of odor sources is accomplished in Ohio municipalities by exercise of the police power of local governmental authorities which allows them to abate various classes of nuisances. Final determination of the existence and classification of these nuisances requires administrative or court decision as to what constitutes a "substantial" number of persons affected and the "reasonable" use of private property. The corrective procedure used involves the successive steps of (1) investigation, (2) administrative hearing, (3) abatement order, (4) correction of condition. Another approach is to prevent the installation of new odor sources by compulsory filing of plans for approval prior to construction, and by zoning. Major problems in zoning are nonconforming use of land because of prior existence in the newly zoned area and the intrusion of higher type land-use (i.e., residential) into zones of lower grade use.

Abatement of odor sources in the Cincinnati metropolitan area

presents a serious governmental problem. The City of Cincinnati is only one of fifty jurisdictions in a metropolitan area of a million people. Although consolidation or annexation to form a major area governmental unit is perhaps considered the ideal political solution, the realities of the situation suggest that a plan for action now can be achieved within the framework of local home rule for all communities involved. A four-point approach is: (1) Set up a voluntary air pollution control district for the jointly affected Kentucky and Ohio communities; (2) Implement this in the Kentucky communities by further action under the State law allowing counties to organize themselves into Air Pollution Control Districts; (3) Have all the communities adopt a uniform air pollution ordinance; and (4) Undertake an integrated area study and research program by arranging for the smaller Ohio communities to contribute financially toward the support of activity by Cincinnati-based air pollution control personnel studying all of the local problems.

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The salient point to remember in this, as in most other air pollution problems is that as Greater Cincinnati is rapidly growing in population, progressively more domestic, industrial, and automotive effluents are being confined in the lower hundred feet of the atmosphere whenever we have a persistent inversion ceiling. An indication of the magnitude of the odor problem lies in the fact that 30 per cent of manufacturing industry in this urban complex is in the chemical and food category. These sources, added to those from waste disposal and

motor vehicle exhaust, make up much of our local problem. Unless each source in the future contributes less pollution, the total pollution thus confined must, of necessity, increase, resulting in more frequent and more intense "smogs" in Cincinnati. The corollary is that the standard for acceptable emission per source must over the years become progressively more stringent.